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ABSTRACT

The purpose of this paper is to make classroom teachers on all educational levels aware of the limitations of readability formulas and the factors affecting readability that are not accounted for by the readability formulas. delineated in discussions of readability formula assumptions, problems, and limitations. Some of the specific factors that are discussed include the reader's prior knowledge of the subject matter, format, organization, text structure, content, style, flow of information, lack of conflict structure, idea and inference density, grammatical and psycholinguistic factors, and reader characteristics. Based on the discussion of these factors, the conclusions section of the paper considers the need for different readability formulas for different users--simpler formulas for classroom teachers doing gross screenings of reading materials and more sophisticated formulas for textbook publishers and textbook adoption committees--and the need for teachers to use readability formulas with understanding and caution. (RL)

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Readability and the Black Box

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Classroom teachers on all levels need more awareness of readability and readability formulas. They need to better understand how to use and interpret the formulas and how to avoid misusing and overrelying on them. They need awareness of the limitations of readability formulas and the factors affecting readability that are not accounted for by the formulas. These factors we will refer to as the "black box." Teachers need to realize the impact on educational materials and perhaps on learning outcomes that result from using readability formulas and what the alternatives to formulas might be. The purpose of this article is to help provide some awareness of these issues.

Interest in Readability Formulas

The increase in interest and use of readability formulas is due to many influences. There is more sensitivity now on the part of the federal government to the jargon and bureaucratese, legalese, and technical styles of writing that cause reading problems for the general public. Increased interest of legislators, school boards and teachers from all levels is no doubt related to the recent concern with basic skills and the decline in reading skills. The declining school enrollment has made publishers of educational materials more competitive, and the use of readability data is used as evidence by publishers that one textbook is superior to another.

Reading researchers are also interested and concerned, so readability research is flourishing. Many researchers are doing predictive

readability research, trying to improve existing formulas or devise new ones that will better predict the difficulty level of texts. Other researchers are doing productive readability research, trying to come up with guidelines for writers to produce more readable writing. Teachers will be increasingly concerned with the findings of both predictive and productive readability research as they face ever-widening spreads of reading ability because of mainstreaming programs for the gifted and handicapped and open enrollment on the college level.

Readability Defined

The term 'readability' has different meanings for different people. It can mean legibility, the reading base, the interest value of a text or the comprehension base resulting from the style of writing. Chall (1958) gives a more complicated, interactive view of readability: "The idea underlying readability measurements is the appropriate matching of reader and printed material" (p. 9). The question can be raised whether actual practice has kept up with this sophisticated definition. Does appropriate matching of reader and printed materials result from the rise of readability formulas?

There is no doubt that teachers do want to match reader and texts appropriately or that the formula developers wanted to help teachers do just this. The intentions of the formula developers were to help teachers and help children learn the content of the text and give them a better reading experience, one that is less frustrating. For a long

time teachers had to do the matching based on their subjective judgments, without benefit of the formulas, if they did matching at all. Neither teachers nor publishers were interested in measuring readability until fairly recently, so formulas, according to Fry (1980), are better than nothing and are a step forward.

Readability Formula Problems

Perhaps formulas are a step forward since they are more objective than teacher judgments, but because the most widely used formulas are based on just three variables--vocabulary, familiarity, word length, and sentence length, they have serious limitations. The problem with the readability formulas is that they do not use as variables the important "black box" factors: content and the reader's prior knowledge of it; format; organization; text structure; content; style; flow of information; lack of conflict structure; idea and inference density; grammatical and psycholinguistic factors; and reader characteristics. We will return to these "black box" factors a little later.

Readability Formula Assumptions

The applicability of readability formulas rests on several basic assumptions that users should recognize (Bruce & Rubin, 1980). These assumptions are that:

1. The test is honestly written--that it is written not to satisfy the readability formula, but rather to satisfy some other communicative goal.

2. Material may be freely read--that there are no time constraints.

3. Higher-level text structures are irrelevant. (The formulas do not take into account organizational materials, information about intentions and goals.)

4. Purpose in reading is irrelevant.

5. Statistical averages are meaningful for individual cases. (Formula use implies that statistical averages regarding both texts and readers can provide useful information regarding the appropriateness of an individual text for an individual person.)

6. Readers you are interested in are the same as the readers on whom the readability formula was validated. (Attempts to expand the use of the formulas to evaluate materials for readers whose background, dialect, and purpose in reading differs from the readers used in validation is likely to lead to difficulties.)

7. It is sufficient to evaluate the readability of a text in terms of lexical and syntactic factors alone, ignoring such factors as pictures, graphic convention, rhyme, and genre.

8. Language rather than conceptual content is the main determiner of text difficulty.

Educators and publishers need to ask themselves what effect these assumptions have on students and educational materials when readability formulas are used for adaptions, selections of texts for readers of different cultural backgrounds, designing special texts for children,

selection of test passages, choosing trade books, television captioning, and designing remedial readers. It is very probable, as Bruce and Rubin point out that because of these assumptions, readability formula use is actually restricted to trivial cases of little importance for educational or social policy.

Bradley and Ames (1978) have listed an additional six (6) readability formula assumptions that are particularly important for classroom teachers using basal readers.

1. The content of a basal varies little in readability. This assumption is not supported since the authors found in their study of thirteen (13) reading level range--from first grade to college in Houghton-Mifflin's Kaleidoscope basal.

2. Readers within a basal series are graded from easy to difficult. This is generally true in terms of averages, but a substantial part of the third reader was more difficult than a substantial part of the fourth reader in the Houghton-Mifflin series.

3. Stories within a basal reader differ little in difficulty from one to another. The authors found in their study that stories in the same book differed in average readability as well as the range of readability and that the difference in readability from one story to another became more extreme as the books increased in overall difficulty.

4. Stories near the beginning of a basal reader are generally less difficult than those at the end. This assumption was not supported.

A story at the beginning of Kaleidoscope had an eighth grade readability level according to the Fry formula while a story near the end was at a second grade level of difficulty.

5. A good estimate of the readability properties of a basal reader may be obtained by using readability information based on a few randomly drawn book samples. The authors found that 24 samples needed to be drawn before there was any consistent agreement with the book level. Fitzgerald (1980; 1981) found essentially the same situation to be true for secondary textbooks and basal workbooks.

6. A student's instructional reading level (IRL) within a basal reading series can be predicted by using a traditionally constructed informal reading inventory. This assumption was found unsupportable because of the extensive intrabook readability variation.

Clearly, teachers must be very careful and cautious about judging basals according to the number the publishers place on the cover.

Black Box Factors

One of the most important factors not considered as a variable in the readability formulas is the content of the text--the conceptual difficulty and the reader's prior knowledge of the concepts and content of the text. For students reading the McCall-Crabbs passages (used to validate the readability formulas) on a specific reading level, there would be wide variation in prior knowledge and content difficulty

in a passage for instance about winters in Vermont and the testing of the atom bomb, Diablo, or a passage about the coastguard activities and one about jet streams. The lexical and syntactic variables would not give a true indication of the readability of these passages.

Format is another factor. Some formats are more familiar to students than others and thus more readable, and some are by their nature more difficult to read and comprehend. Fairy tales and short stories are no doubt on a different readability level than math story problems and argumentative essays. A literary description of a haunted house would be on a different level than a technical description of a tool or a real estate ad. Genre and discourse types vary considerably in readability levels. The organization of a text makes a difference in readability, too. Texts can be organized inductively or deductively, spatially, temporally, climatically, all of which makes a difference in the readability level of texts.

Recent research by Kintsch and Vipond (1977) suggests some other factors that are part of the "black box" of readability. Looking at text structure which involves higher-level text features, these researchers analyzed passages that had been measured with readability formulas and found that some which were predicted to be easy were in fact difficult to process because of these factors:

1. number of propositions in a text (density of ideas).
2. number of different arguments.

3. number of coherence networks.
4. number of inferences required.
5. number of long-term memory searches and reinstatements of propositions into short-term memory.
6. number of reorganizations required to arrive at the best-organized text base.

These researchers believe that readability must be theory-based and that readability formulas are atheoretical. Investigating readability within the framework of their text analysis model, they suggest that the concept of readability is beyond salvation. Readability is not somehow an inherent property of texts, but is the result of the interaction between a particular text (with its text characteristics) and particular readers (with their information-processing characteristics). Readability must be defined for specific texts and specific readers and the single readability score replaced with a readability profile that shows how a particular text would be responded to by different readers. Kintsch and Vipond suggest that such measures as reading time, amount recalled, and number of questions answered correctly are better indicators of readability than formulas, when these measures are theory dependent.

Readability formulas are not sensitive to context; some contexts make a word easy to understand and other context make the same word difficult to understand--metaphors for example. The word familiarity variable is a problem, too, since a single measure is used. What is

not considered in word familiarity is the context the word is used in, the difference between oral and written familiarity, and the background of the reader.

Style is also part of the "black box." There are styles that suit and styles that do not. Readers find texts readable or not because of an author's style--his manner of expression and the tone or mood of the text. Whether a reader is put off or attracted to a text, considering it nonreadable or readable, depends not only on text structure, format, organization, and content, but also on style and tone.

Discourse analyst Vonda Kopple (1980) is critical of readability formulas because they do not consider flow of information. The relationships between sentence topics is a very important factor of readability, for expository prose paragraphs with identical or related sentence topics are easier to read. Bruce and Rubin (1980) are critical of basal stories constructed to conform to readability formula constraints, for they lack coherence and ignore other crucial characteristics of texts. The basal selections are hard to read because there is no familiar structure of conflict and resolution expectation and because of the lack of conflict, suspense, purpose, humor and point of view. Remedial reading texts are another of their concerns. Readability formulas are used in designing and choosing remedial reading texts, but this approach fails to take account of certain problems. In these texts, maintaining a coherent story line is less important than

introducing the written forms of particular sounds such as o and u. The higher level structures are ignored since the text is written just to do the teaching function, thus making them less readable unnatural texts.

Although text structure factors are very much a part of the "black box," so are grammatical factors. The results of a study by Charrow (1980) indicated that grammatical complexity is at the root of the difficulties with legalese. For instance, when jury instructions were rewritten, comprehension for the jurors increased, even though the Flesch readability formula had predicted the original instructions should be readable. Readability formulas with their variables of vocabulary familiarity, word length, and sentence length, and in the case of the Flesch formula, the additional variable of second person pronouns, do not consider grammatical complexity. Yet, readability is affected by unusual placement of phrases, certain grammatical constructions such as the as to construction, multiple negatives, nominalizations, strings of adjectives or lists of nouns, some passives, and paraphrases of ideas, etc. When a text has grammatical complexity, making it more readable requires increasing paragraph and sentence length by adding more context for clarity. Readability formulas, however, would give the rewritten text a higher reading level because of the increased sentence length.

Since reading is a personal, interactive process, the text itself is not the only thing to consider for readability. Bruce and Rubin

(1980) mention eight factors that can affect readability for a student:

1. How do I feel--tired? hungry? eyes hurt? distracted? preoccupied?
2. How interested am I in the topic or story?
3. What do I know about the subject--what is my background knowledge?
4. How similar is the writer's language to mine?
5. How plausible do I think the author's beliefs, presuppositions are? What do I take for granted?
6. Why am I reading this? for facts? general knowledge? escape?
7. How long do I have to read this? How does this affect my reading goals?
8. What do I want to do with the information?

Clearly these reader characteristics, as well as task and text characteristics are important factors for ascertaining readability and consequently are part of the "black box."

Other Readability Formula Limitations

Teachers certainly need to be aware of the "black box" factors not considered in readability formulas and the assumptions they are based on. But there are other problems with readability formulas. The sampling procedure problem has been mentioned previously. Another is the validity problem. Validation studies have been unbelievably weak and circular in nature, validating one formula against another and

measuring simply what is taught in the basal readers rather than real-world literacy. The McCall-Crabbs criterion passages are dated in regard to both materials and norms and are quite similar to those in basal readers. The formulas are based on elementary level passages but are supposed to be predictive up to adult reading levels. The use of cloze tests as a measure of comprehensibility is questionable since the psychological processes are not the same in cloze tests as the ones in reading a text. Also there is great variability among the formulas in estimating grade level; with some texts there can be a four grade level difference between one formula and another. The readability formula scores are imprecise and unreliable (Seldon, 1980; Fry, 1980).

Chall (1977; 1979) also sounds a note of caution about the use of readability formulas for matching books and readers. None of the readability formulas tells how difficult reading materials should be. They seem to have been used mainly to write, edit, and select easier books. The whole issue of how best to match the readability of a text to the ability of a reader for optimal reading comprehension and learning is widely discussed but unresolved. A recent study of textbooks in relation to declining SAT scores found that the decline was associated with a decline in difficulty of textbooks over a 30-year period and that a recent increase in difficulty in primary school texts was associated with rising reading scores. This suggests that texts that are too easy may produce lower scores on verbal tests and may be detrimental to the development of high level reading and

interpretation skills. The concern should go, it seems, not only to books that may be too difficult but to those that may be too easy.

In spite of all this, the preference for easy textbooks is still strong. Publishers claim that teachers of the elementary grades are requesting science and social studies textbooks two years below the grade placement of the children. MacGinitie (1981) points out that there are two ways to make text easier to read. One is to eliminate text characteristics that cause many students difficulty. The other is to give students help and experience in understanding text that has those characteristics. There are also two ways to make text difficult to read. One is to include text characteristics that cause many students difficulty. The other is to insulate students from help and experience in reading text with various characteristics. MacGinitie would like teachers to realize that choosing short-sentence versions of materials for students because the students are accustomed to reading that sort of text is the wrong way to go. Instead, teachers should choose material where ideas are easier to understand because sentences are longer and make use of sentence structure to specify relationships. The materials that teachers give students to read determine in large part, current reading abilities and readability findings. Green (1981) agrees and proposes abandoning all adaptions in basals and using age appropriate natural texts since the current

procedure for "simplifying" texts result in making texts unnatural, more difficult to understand, and less interesting than the originals.

Conclusion

In the future we must fit readability formula research and findings more completely into the larger picture of reading behavior and human behavior more generally. We need different formulas for different users. Classroom teachers doing gross screening can use a simpler formula; publishers doing extensive measuring and textbook adaption committees need accuracy and a sophisticated complex formula. A scientific approach is now necessary for readability formulas rather than the earlier practical approach (Klare, 1979). And a clearer theoretical approach to readability is mandatory (Kintsch & Vipond, 1977). Researchers must take the "black box" factors into account. Support of readability research and application must come not only from universities and the government but also from the book industry, particularly the textbook sector (Chall, 1979). Readability formula research must be an interdisciplinary endeavor. Linguists, psycho-linguists, socio-linguists, cognitive psychologists, discourse analysts, rhetoricians, and reading educators must all work together to determine what constitutes the "black box" of readability.

And teachers must use readability formulas with understanding and caution. It is obvious that while formulas seem to provide simple ways of measuring readability, they are only a place to begin. "Teachers

need to have some idea of their students' background, knowledge, ways of thinking, present educational level, their vocabulary use, their familiarity with other writing because all that makes a difference in how hard it is to read a passage," notes Fry (1980). In other words, teachers must become aware of the many factors that make up that "black box" of readability and rely more on their own informal subjective judgment in matching readers and texts.

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